

# **Instrumentation to Measure Bottom Roughness from GEOPROBE Tripods**

Christopher R. Sherwood  
U. S. Geological Survey, Coastal and Marine Geology  
384 Woods Hole Road  
Woods Hole, MA 02543-1598  
phone: (508) 457-2269 fax: (508) 457 2310 email: [csherwood@usgs.gov](mailto:csherwood@usgs.gov)

Award Number: N0001401F0263  
<http://woodshole.er.usgs.gov/>

## **LONG-TERM GOALS**

The long-term goal of our research is to improve our ability to model sediment transport and accumulation in coastal oceans. In particular, we hope to develop regional-scale models (~10s of kilometers) with predictive capability over time scales of decades. Such models are useful for a wide range of engineering, environmental, and tactical Naval applications. Field observations and measurements of sedimentary processes are a key component of our research, because careful quantitative data are needed to improve parameterizations of sedimentary processes and to test existing models. Measurement of bottom topography is crucial for interpretation of boundary layer processes because bottom roughness directly affects near-bottom flow, and sedimentary processes can alter bottom morphology.

## **OBJECTIVES**

The technical objective of this effort is to enhance existing benthic boundary layer (GEOPROBE) tripod instrumentation by adding scanning sonar capabilities. The instruments acquired in this project will be deployed a tripod or other fixed platform and will provide time series of profiles and images of small-scale (vertical scales of centimeters, horizontal scale of a few meters) bottom topography. These data will be used in conjunction with other measurements to improve our understanding of bottom boundary layer processes, with particular emphasis of sediment erosion, transport, and deposition. Our acquisition of these instruments will contribute of a pool of mature and quasi-standardized instrumentation for potential use in ONR field measurement programs.

## **APPROACH**

We are collaborating with several other ONR investigators to design and build a standardized scanning sonar profiling and imaging system. We plan to buy the sonar head and components from a vendor and build a data logger and battery case according to a standardized design. The system will include an imaging sonar head to provide information about seabed topography within a few meters of the tripod, and a pencil-beam profiling sonar head to acquire more quantitative data along a transect within the image area. We are working closely with other ONR investigators as we build the data logger, implement logging and control software, and develop data processing methodology to minimize redundant efforts and provide systems that are complementary.

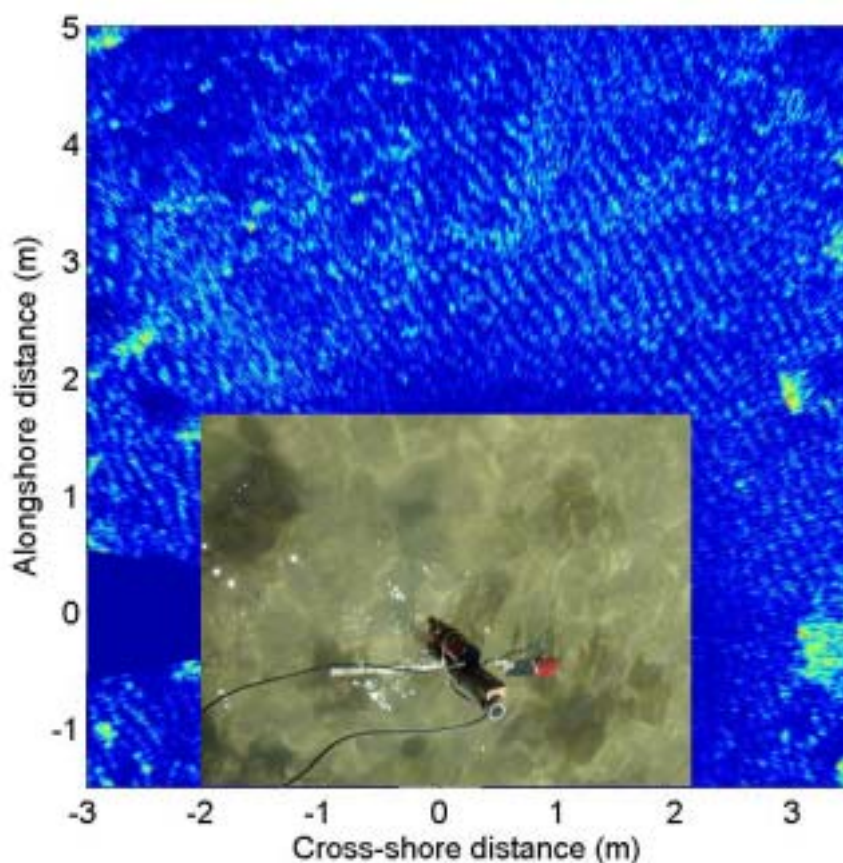
Report Documentation Page			Form Approved OMB No. 0704-0188		
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE <b>30 SEP 2002</b>		2. REPORT TYPE		3. DATES COVERED <b>00-00-2002 to 00-00-2002</b>	
4. TITLE AND SUBTITLE <b>Instrumentation to Measure Bottom Roughness from GEOPROBE Tripods</b>			5a. CONTRACT NUMBER		
			5b. GRANT NUMBER		
			5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S)			5d. PROJECT NUMBER		
			5e. TASK NUMBER		
			5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>U. S. Geological Survey, Coastal and Marine Geology,,384 Woods Hole Road,,Woods Hole,,MA, 02543</b>			8. PERFORMING ORGANIZATION REPORT NUMBER		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)			10. SPONSOR/MONITOR'S ACRONYM(S)		
			11. SPONSOR/MONITOR'S REPORT NUMBER(S)		
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release; distribution unlimited</b>					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT <b>The long-term goal of our research is to improve our ability to model sediment transport and accumulation in coastal oceans. In particular, we hope to develop regional-scale models (~10s of kilometers) with predictive capability over time scales of decades. Such models are useful for a wide range of engineering, environmental, and tactical Naval applications. Field observations and measurements of sedimentary processes are a key component of our research, because careful quantitative data are needed to improve parameterizations of sedimentary processes and to test existing models. Measurement of bottom topography is crucial for interpretation of boundary layer processes because bottom roughness directly affects near-bottom flow, and sedimentary processes can alter bottom morphology.</b>					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT <b>Same as Report (SAR)</b>	18. NUMBER OF PAGES <b>4</b>	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>			

## WORK COMPLETED

All work on this project was successfully completed this year. We purchased two sonar units, an Imagenex model 881A, which we operate as a profiler, and an Imagenex model 881, which we operate as an imaging device. We arranged to have a data logger constructed and programmed by Dr. Jim Irish and Ms. Robin Singer of Woods Hole Oceanographic Institution. Ms. Marinna Martini of the USGS designed and constructed pressure cases for the data logger and a battery pack suitable for autonomous remote deployment. The completed sonar and data logger systems were successfully tested by imaging small ripples formed of fine sand in shallow waters of Vineyard Sound. Details of the data logging system are described by Irish et al. (2002). Source code for the two-sonar head logging program is available from the USGS.

## RESULTS

Dockside testing of the sonar and data logger indicated that it operates correctly and can image small ripples (Figure 1).



*Figure 1. Sonar image of small ripples in fine sand (wavelength of approximately 10 cm, heights of 1-2 cm), with scattered cobbles and boulders. Superimposed is a photo looking down on the sonar systems as deployed at the same shallow-water test site. The scale applies to the sonar image; area in the photograph is approximately 1 meter across.*

## **IMPACT/APPLICATIONS**

The sonars and datalogger developed under this project will be deployed along with other USGS equipment as part of the EuroSTRATAFORM field study along the Adriatic Coast. This experiment is scheduled for Autumn 2002 – Winter 2003. In addition, we expect that the datalogger technology will be used by other ONR researchers in EuroSTRATAFORM, Mine Burial, or other programs.

## **TRANSITIONS**

None.

## **RELATED PROJECTS**

The instruments developed in this project will be deployed as part of the EuroSTRATAFORM project.

## **PUBLICATIONS**

Irish, J., R. Singer, J. Zhang, G. McDonald, and P. Traykovski (2002) *Low-Power Remote Recorder for the Imagenex Scanning Sonar Head*. WHOI Technical Report (in preparation).